REMARKS

In the Office Action, claims 1-36 were rejected. Applicant respectfully asserts that these claims, as originally filed, are patentable and in condition for allowance. Reconsideration and allowance of all pending claims are requested.

In the Office Action, the Examiner objected to the drawings. Specifically, the Examiner objected to drawings because, "the enlarged view in figure 2 is not labeled separately or properly." *See* Paper 2, pages 2, 11. Applicant respectfully asserts that the drawings are, in fact, proper and in accordance with all applicable requirements.

The relevant portion of the C.F.R., namely 37 C.F.R. § 1.84(u), delineates the requirements for numbering selected views within the figures. This section states that, "different views must be numbered in consecutive Arabic numerals," and that, "partial views *intended to form one complete view*, on one or several sheets, must be identified by the same number followed by a capital letter." *See* 37 C.F.R. § 1.84(u) (emphasis added). With that in mind, Applicant respectfully asserts that the magnifications depicted in Figure 2 neither *intend* to form nor appear to form additional complete views. Rather, the magnifications are provided as tools to further clarify the figure as a whole. As such, Applicant respectfully asserts that the figure complies with the given requirements. Moreover, Applicant asserts that for the purposes of explanation, the magnifications are best maintained under the label of Figure 2. However, if the Examiner remains convinced on labeling the magnifications as separate views in spite of the foregoing remarks, in the interest of expediting prosecution, Applicant would consider amending the application as per the Examiner's request. At the present time, however, withdrawal of the objection is respectfully requested.

Rejections Under 35 U.S.C. § 102

The Examiner rejected claims 1, 2, 9-13, 16-18, 21, 27-30, 34 and 35 under 35 U.S.C. § 102 (b) as being anticipated by Giebler (5,878,146). Applicants respectfully

traverse this rejection. A *prima facie* case of anticipation under 35 U.S.C. § 102 requires a showing that each limitation of a claim is found in a single reference, practice or device. *In re Donohue*, 226 U.S.P.Q. 619, 621 (Fed. Cir. 1985).

It is striking that the cited reference, which discloses a crystal X-ray diffraction system, never mentions the cropping of image data, or the determination of whether a projection area falls within a detector framework or boundaries. Indeed, unlike the present application, the reference does not address the situation of an image area different in size than the detector boundaries. Moreover, the only discussion of asymmetry in the Giebler reference is the asymmetrical orientation of the crystal plane. Column 8, lines 36-41. Therefore, as discussed below, Applicants respectfully submit that the subject matter of independent claims 1, 11, 21 and 30, as well as the claims dependent thereon, is not anticipated by Giebler reference. Accordingly, Applicants request withdrawal of the Examiner's rejections and allowance of claims 1-36.

The present application provides for cropping image data in asymmetrical imaging. In digital X-ray, asymmetrical imaging may be applied by rotating and/or angular translating a radiation source assembly or by swiveling the associated beam collimation device with respect to an imaging plane. The projection area of an imaging X-ray beam is then determined based on positions of the radiation source and collimator (as separate components or as an assembly) in three independent directions in space. As illustrated in Fig. 4 of the present application, various positioning of the X-ray source, the beam collimator, and the detector allow for considerable latitude in selecting a segment of a subject which will be imaged.

As described in the instant application, for the case of a detector area substantially larger than the image area, electronic cropping improves computational efficiency by reducing the total amount of data processed (i.e., automated sampling of data may be selectively applied to pixels in the desired image area, with the remaining pixels being

considered to contain little or no useful information). An exemplary positioning is illustrated in Figs. 8 and 9, in which a point source 88 has been rotated *off* of an orthogonal line between the source and an imaging plane 100. The corresponding exemplary image area is bounded by vertices 170, 172, 174 and 176 (at locations where the corresponding lines 130, 132, 134 and 136 project to the image plane). The image area 178, then, corresponds to the area where the useful image data should be collected.

The present technique also allows for determining whether the projection area falls within a detector framework or boundaries. Where such is not the case, an operator may be notified via an alert to correct or inhibit the exposure. If the projection area is within the detector boundaries, the operator is able to displace the source assembly with respect to the detector center and still produce an acceptable diagnostic image that fully captures the anatomical features of the region of interest. As shown in Figs. 4 and 5, asymmetrical imaging applications, such as with beam 16 in plane 100, may permit exemplary projections 118 and 120 to be formed off of centerline 116.

Dissimilarly, the Giebler reference is directed to the use of diffracting crystals to give a preferred X-ray beam path using a conventional X-ray point source. Abstract; Column 1, lines 6-13. In the reference, an X-ray imaging system uses diffractive X-ray optics to give low dose, high definition imaging in Mammography. Column 1, lines 13-15. To mitigate Compton scatter, crystal arrays are configured so that scatter is not detected. Column 1, lines 42-49. In fact, only rays normal to the image plane are detected. Column 10, lines 37-53. To accomplish the desired configuration, crystal segments and segment holders are constructed with toric boundaries and are situated between the source and the patient and between the patient and the detector. *See* column 3, lines 22-40. This configuration enables X-ray energy to be gathered from a conventional X-ray source over a relatively large solid angle, with the segmented crystal surface causing diffraction from the source. Column 8, lines 10-17 (noting that the Giebler device employs a large cone of emitted X-rays with an emission from the entire surface of the source target area).

In particular, X-rays from the X-ray source impinge on a toric monochronometer having monochromatic Bragg X-ray diffraction. Column 2, lines 48-52. The diffraction radius and crystal matrix radius of the toric monochronometer are preferably sized to give *asymmetric diffraction for the purpose of generating monochromatic X-rays*. Column 2, lines 48-52. Applicants note that reference never deals with asymmetric imaging but only asymmetric diffraction. On the whole, the X-ray optics scheme disclosed in the Giebler reference allows a large area to be imaged with a higher intensity while still using a conventional rotating anode as the electron target and X-ray source. Column 3, lines 49-56. And it is only monochromatic X-rays that reach the detector through the second crystal (analyzer) array. Column 3, lines 35-56.

The Examiner cited column 3, lines 1-5, column 4, lines 32-36, and column 8, lines 19-28 of the Giebler reference as disclosing the recited features of rejected claim 1. Applicants, however, have carefully reviewed the portions of the Giebler reference cited by the Examiner, as well as the remainder of the Giebler reference, and respectfully disagree that the reference discloses all of the recited features of claim 1. For example, the Giebler reference fails to disclose, "identifying a projection of a radiation beam in an image plane," as recited by claim 1. Instead, the Giebler X-ray diffraction system is configured such that identification of a projection in the image plane is not performed. Indeed, the Giebler reference does not discuss the orientation of the projection in the image plane at all. Moreover, the Giebler crystals are oriented so that imaging planes are automatically taken normal to the mean path of the expanding beam. *See* Abstract; column 10, lines 37-53; column 5, lines 16-18 (explaining that the specimen is scanned in segments "taken normal to the mean scan direction of the interrogating X-rays").

The cited reference also fails to disclose "the projection being asymmetrical with respect to an axis of the image plane," as recited by rejected claim 1. Instead, the reference does not disclose asymmetrical imaging. The only mention of asymmetry in the Giebler reference is of the asymmetrical orientation of the crystal plane. Column 8, lines

36-41. The portion of the reference (column 8, lines 19-28) cited by the Examiner has nothing to do with the image plane or asymmetrical imaging. The cited text describes electrons discharging from a cathode and hitting an X-ray generating source (such as a rotating anode target). Thus, the text discusses the X-ray source, a part of the disclosed system *far upstream of the image plane.*

The Giebler reference also fails to disclose, "processing image data for a portion of a digital detector based upon the identified projection," as recited by rejected claim 1. After all, the reference does not identify an asymmetrical projection with respect to the image plane, and thus it is not possible for the reference to disclose the processing of image data *based upon this identified projection.* Moreover, the reference never discloses that image data is processed for a *portion* of a digital detector. Indeed, the reference does not address the cropping of image data or the situation of an image area being smaller than the detector boundaries.

The Examiner incorrectly cites column 3, lines 1-5 of the reference as disclosing the processing of image data based upon the identified projection, as claimed. This section of the reference instead refers to the monochromatic X-rays passing through a specimen with the detector receiving "induced" image information. Again, it is only the X-rays that are not absorbed, refracted, or scattered in the specimen that even reach the detector. Column 5, lines 2-7 (asserting that image information is *imparted* to the remaining transmitted rays); column 8, lines 48-51 (noting that the Bragg angle must be *identical* on both crystals for the ray to reach the detector). The reference simply does not consider asymmetric imaging or the identification of a projection asymmetrical to an axis of the image plane.

The Examiner also cited column 4, lines 33-36, reproduced as follows: "[a]nother benefit of this invention is that it is capable of either digital or film detection. A unique mechanical embodiment to provide these capabilities is presented. A unique operational

systems description is presented." It is clear that this citation is misplaced. Applicants respectfully request that the Examiner clarify the citation of column 4, lines 33-36.

As for the independent claims 11 and 21 of the present application, Applicants respectfully disagree that the portions of the Giebler reference cited by the Examiner disclose the recited features of claims 11 and 21. Several examples of the failure of the Giebler reference to anticipate the subject matter of the claims are given below. For instance, the cited reference does not disclose orienting a radiation beam or assembly to project a beam "towards an image plane to impinge the plane asymmetrically with respect to an axis of the plane," as recited by claims 11 and 21. Again, the only discussion of asymmetry in the Giebler reference is with respect to the crystal configuration, not to a beam within the image plane.

The cited reference also fails to disclose the radiation beam impinging a "region of a detector extending into the image plane, the region being smaller than an imaging surface of the detector," as recited by claims 11 and 21. No such disclosure is made by the reference. Indeed, the Giebler reference appears to be totally silent as to the extent of the detector impacted by the X-ray beam. Similarly, the Giebler reference fails to disclose, "computing an image area over which the beam impinges the plane" and "processing image data from the region of the detector including the image area," recited by independent claims 11 and 21. As indicated previously, the reference never mentions the cropping of image data or determining whether a projection area falls within a detector framework or boundaries.

As for independent claim 30, the Examiner stated that the rejection analysis is the same as that for independent claim 21. Applicants assert, however, that the Giebler reference also fails to anticipate the subject matter of independent claim 30. For example, the reference does not disclose a radiation source assembly that is "orientable with respect to an imaging plane to produce an asymmetrical image area," as recited by claim 30.

Indeed, the source and detector of the Giebler reference appear to be coupled, therefore moving in synchrony. *See* Figs. 3 and 4. Such a configuration does not disclose or suggest the ability to produce an asymmetrical image area. Instead, no asymmetric image area is disclosed but only asymmetry in the crystal orientation. For example, successive rows in each crystal array have "an increasing asymmetry in crystal plane orientation in order to emulate a larger single crystal Johannson monochromator." Column, lines 35-41 (noting that the crystals are arranged in arrays only for the purpose of manufacture). The reference never mentions an "asymmetrical image area." As for the detector, the reference mentions that segmenting the detector and using an asymmetrical orientation allows the array to be curved to minimize geometric aberrations in the image reconstruction, and facilitates maximization of the data transfer rate. Column 7, lines 60-67. The asymmetry discussed in Giebler, unlike the present claims, clearly has nothing to do with the imaging area or imaging plane, but instead is applied in the crystal configuration.

The reference also fails to disclose a "digital detector extending in the imaging plane *and having an imaging surface larger than the image area*," as recited by claim 30. Likewise, the reference fails to anticipate a control circuit to process image data from the detector to the "exclusion of data from portions of the imaging surface outside the image area," as recited by claim 30.

In view of the remarks set forth above, Applicants respectfully submit that the subject matter of independent claims 1, 11, 21 and 30, as well as the claims dependent thereon, is not anticipated by the Giebler reference. Accordingly, Applicants respectfully request withdrawal of the Examiner's rejections and allowance of claims 1-36.

Applicants also note that the dependent claims are also patentable for additional reasons by virtue of the subject matter recited in each dependent claim. For example, the cited reference fails to disclose the recited features of dependent claim 18. The

Examiner's citing of column 14, lines 41-47 of the Giebler reference as disclosing the recited features of claim 18 is misplaced. Applicants have carefully reviewed this portion of the Giebler reference and respectfully disagree with the Examiner's characterization. The cited text clearly does not disclose the step of "generating an operator alert if the image area is not encompassed by the imaging surface of the detector." Instead, the text lists various parameters that the operator defines before initiating an exposure.

Rejections Under 35 U.S.C. § 103

The Examiner rejected claims 3-8, 14, 15, 19, 20, 22-26, 31-33 and 36 under 35 U.S.C. § 103(a) as being unpatentable over Giebler (5,787,146) in view of Deckman et al (4,891,829). Applicants respectfully traverse this rejection.

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination. *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination includes *all* of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985).

Initially, as discussed above, Applicants note that all of the independent claims are believed to be allowable over the Giebler reference. The Examiner relied upon the Deckman et al reference to disclose or teach "specific details regarding the step of identifying the projecton includes sensing orientation of a collimator and computing locations of incidence of the radiation beam in the image plane," citing column 14, lines 1-35 of the Deckman et al. reference. However, the Deckman et al. reference does

nothing to obviate the deficiencies of the Giebler reference discussed above. Therefore, all of the cited dependent claims are believed to be allowable by virtue of their dependency on their respective allowable base claims 1, 11, 21, and 30. Accordingly, Applicants respectfully request withdrawal of the Examiner's rejection and allowance of claims 3-8, 14, 15, 19, 20, 22-26, 31-33 and 36.

Furthermore, the dependent claims rejected under 35 U.S.C. § 103 (a) are also patentable for the subject matter they separately recite as well. As discussed above, in the present application, the source, collimator and detector are positioned, with the source and collimator being angularly positioned and rotated in accordance with the degrees of freedom available in the particular imaging system. Then, the position data regarding the angular displacement of the source and collimator, and their rotation, if any, is detected, such as via conventional position sensors. The image area is computed as discussed above with reference to the transformation matrices. With the impingement points in the image plane thus identified, the process may determine whether the image area is within the detector imaging surface bounds (if not, the operator may be notified, or the imaging sequence may be inhibited). Once appropriate correction has been made, or if the impingement area is found to be within the bounds of the detector, the desired exposures may be made. The image data are then read out and cropped, either during the readout process or subsequently thereto.

Conversely, the Deckman et al. reference is directed to a new type of detector for computerized tomography. Column 3, lines 27-29. The Deckman et al. method uses an imaging electro-optic detector to acquire computed tomographic data. Column 1, lines 47-52. Electro-optic radiation detectors are broadly defined as position sensitive detectors which amplify and record optical images. Column 3, lines 54-56. The reference asserts that by using an electro-optic detector instead of conventional scintillation detectors, spatial resolution and physical scale in reconstructed images can be significantly improved. Column 1, lines 47-52; column 3, lines 55-60.

The Deckman et al. technique produces tomographic images of an object irradiated by a beam of collimated radiation transmitted through a set of coplanar sections of the object. The electro-optic detector records and alters the image information. Column 2, lines 8-15. The reference discloses a collimation device and discusses various collimation techniques. *See, e.g.*, column 14, lines 1-36. However, the cited reference does not disclose, as presently claimed, the use of a collimation device in asymmetrical imaging, for example, by orienting and sensing the orientation of the collimator (and/or with computing an image area for cropping or for determining the relative position of the image area to the detector). In sum, the Deckman et al. fails to recite all of the features of the rejected dependent claims. Accordingly, the Examiner has failed to establish a *prima facie* case of obviousness.

Finally, the Examiner has failed to provide a convincing line of reason to combine the cited references. It is well settled that when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988). One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). The Examiner asserts that it would have been obvious to one of ordinary skill in the art to use the electric-optic detector (of Deckman et al.) instead of conventional scintillation detectors to improve spatial resolution and physical scale in reconstructed images in the Giebler device. Applicants respectfully disagree. Indeed, the Giebler reference does not teach, suggest, or disclose that anything other than a conventional scintillation detector would be desirable to detect the monochromatic X-ray beam taught therein, nor would it be obvious to try such an alternative detector. Likewise, the Deckman reference does not reach, suggest, or

disclose the desirability of using the detector taught therein in conjunction with a monochromatic X-ray beam. Only impermissible hindsight would suggest such a combination. In sum, the Examiner has failed to establish a prima facie case of obviousness for this reason as well. Accordingly, claims 3-8, 14, 15, 19, 20, 22-26, 31-33 and 36 are believed in condition for allowance.

Conclusion

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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